Case Report Rapport de cas

Long-term survival of a cow with cervical ectopia cordis

Ken Onda, Masanori Sugiyama, Keeko Niho, Reiichiro Sato, Sachiko Arai, Kazuyuki Kaneko, Seigo Ito, Makoto Muto, Tsunenori Suganuma, Yoshito Wakao, Yasunori Wada

Abstract — This study investigated the long-term survival of a calf with cervical ectopia cordis that grew normally, became pregnant, and calved normally. The cow showed normal cardiac function and absence of peripheral circulation abnormalities. This paper documents antemortem characteristics of the affected cow.

Résumé — Survie à long terme d'une vache atteinte d'une ectocardie cervicale. Cette étude a examiné la survie à long terme d'une génisse avec une ectocardie cervicale qui a grandi normalement, est devenue gravide et a vêlé normalement. La vache présentait une fonction cardiaque normale et l'absence d'anomalies de circulation périphérique. Cet article documente les caractéristiques ante-mortem de la vache affectée.

(Traduit par Isabelle Vallières)

Can Vet J 2011;52:667–669

Ectopia cordis is a congenital heart disease wherein the heart is located outside of instead of within the pleural cavity. This disease is classified into 3 types on the basis of the location of the heart — cervical, thoracic, and abdominal. A total of 118 cases of ectopia cordis have been reported in cattle (1); cervical ectopia cordis accounted for 82% of the cases, thoracic ectopia cordis for 14%, and abdominal ectopia cordis for 3%. Forty of the 42 cattle that survived over 6 wk had cervical ectopia cordis (1). Cows with ectopia cordis include 1 that had normal parturition and another that survived until the age of 14 y (2,3). However, detailed antemortem examinations were not performed in these cases.

In the present study, X-ray examination, ultrasonography, and blood examination were performed to monitor a Holstein calf that grew normally, became pregnant, calved, and lactated, despite suffering from cervical ectopia cordis.

Case description

A 5-day-old female Holstein calf (body weight 39 kg) was admitted to the Animal Hospital of Azabu University School of Veterinary Medicine and diagnosed with cervical ectopia cordis after chest auscultation (Figure 1). Although no heart sound was audible in the chest area, the sound was audible in the neck where the pulse was detected. Physical examination revealed satisfactory vital parameters — the body temperature, heart rate, and respiratory rate were 38.8°C, 130 beats/min, and 28 breaths/min, respectively. No changes were observed in the visible mucous membranes and no other abnormal findings or clinical anomalies were observed.

Electrocardiography using unipolar leads from the cervical region showed normal rS configuration, and there was no arrhythmia (Figure 2). Lateral chest X-ray examination revealed that the heart was displaced from the pleural cavity (Figure 3A). A sternum deformity was observed, similar to that mentioned in a previous report (4). Lateral cervical X-ray examination revealed that the bulge in the cervical region was greater in the Holstein calf in this study than in normal calves, and that the cervical mass elevated the trachea (Figure 3B).

Ultrasonography revealed cardiac heterotaxia with a cardiac apex that was directed cranially (Figure 3). At 5 days of age, in the 4-chamber view obtained from the left side of the neck, the septal leaflet of the tricuspid valve was positioned toward the cardiac apex approximately 23 mm from the insertion of the anterior leaflet of the mitral valve (Figure 4). The distance between the septal leaflet of the tricuspid valve and the insertion of the anterior leaflet of the mitral valve was 6.8 ± 0.6 mm [mean ± standard deviation *(s)*] in 3 healthy Holstein calves at 2 mo of age; therefore, in our calf, dysplasia of the tricuspid valve was confirmed as a cardiac malformation.

At 2 y and 5 mo of age, pregnancy was confirmed in the cow by ultrasonography; its body weight at that time was 541 kg (the gestational age of the fetus was 40 d). The cow calved normally at 3 y and 1 mo of age and did not suffer from any periparturient disorders (Figure 1). The newborn female calf was clinically healthy and had no morphological abnormalities. Milk production peaked at 27 kg/d at 2 mo postpartum; this

Laboratory of Internal Medicine 3 (Onda, Sugiyama, Niho, Sato, Wada), Laboratory of Internal Medicine 1 (Arai, Ito), Laboratory of Clinical Reproduction (Kaneko), Laboratory of Surgery 2 (Muto), Laboratory of Radiology (Suganuma), and Laboratory of Surgery 1 (Wakao), Azabu University School of Veterinary Medicine, 1-17-71 Fuchinobe, Sagamihara 229-8501, Japan.

Address all correspondence to Dr. Ken Onda; e-mail: onda@azabu-u.ac.jp

Figure 1. Holstein cow with cervical ectopia cordis at age 3 y and 1 mo and weighing 550 kg. Inset shows the same animal as a calf at 5 days of age and weighing 39 kg.

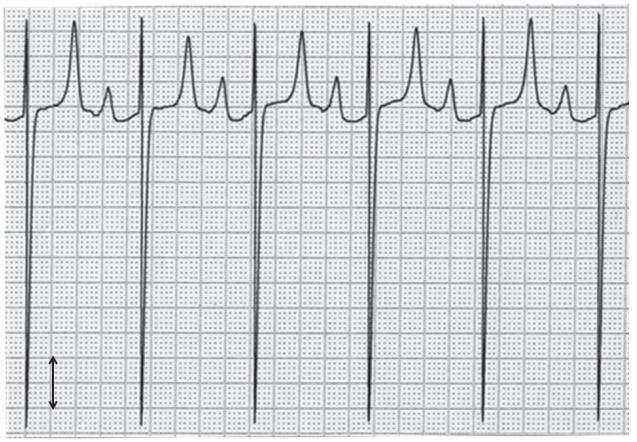

Figure 2. Electrocardiographic patterns in the calf with cervical ectopia cordis at 5 days of age. An rS configuration is observed using unipolar leads from the cervical region. Arrow – 10 mm = 1 mV. Time interval – 50 mm/s.

was similar to the milk production of primiparous cows in the herd. Subsequently, a return to estrus was observed.

The velocity of the blood flow in the cow at age 2 y and 5 mo as measured by the color Doppler was very low despite the extended apical displacement of the tricuspid valve (43 mm); we also observed reverse blood flow in the right atrium directly above the tricuspid valve (data not shown). Except for dysplasia of the tricuspid valve, there were no other abnormalities such as vascular anomalies and defects. The internal diameter of the left ventricle was 86 mm and 48 mm in the diastolic (LVd) and systolic (LVs) phases, respectively, as measured by the M-mode method. The shortening fraction in the internal diameter of the left ventricle (FS) was 44.2% at age 2 y and 5 mo. These values are within the normal range in cows (reference values: LVd, 75.4 ± 8.0 mm; LVs, 39.7 ± 11.6 mm; FS, 43.5 ± 5.8%; mean ± *s*) (5). At age 3 y and 4 mo (3 mo postpartum), the shortening fraction in this cow was within the normal range (43.3%).

From the time of admission to the Animal Hospital to the age of 3 y and 4 mo, no abnormalities were observed in the cow with respect to blood tests, blood biochemistry, and blood gas analysis (data not shown).

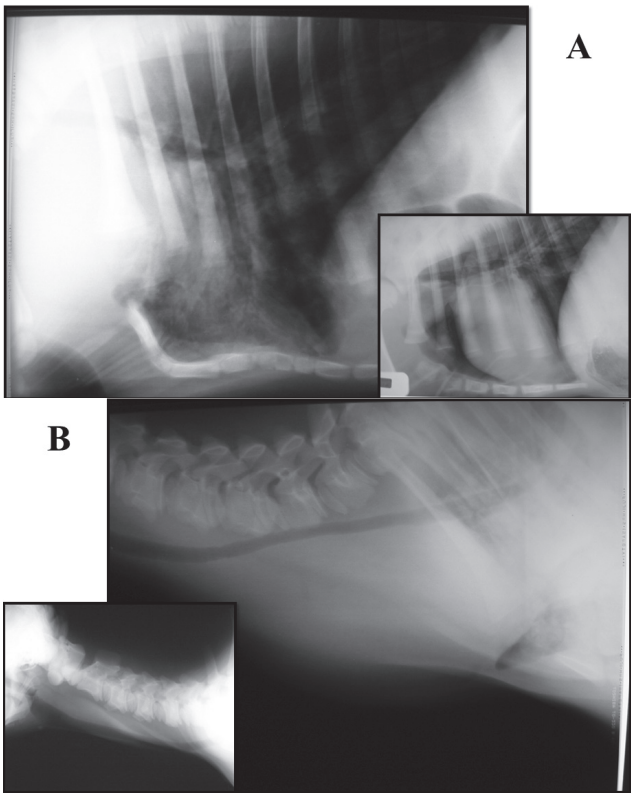

Figure 3. X-ray image of the calf with cervical ectopia cordis at 5 days of age. Lateral chest X-ray shows the displacement of the heart from the pleural cavity along with a sternum deformity (A). Lateral cervical X-ray examination revealing the elevation of the trachea attributable to the cervical mass (B). Insets of A and B are lateral X-ray images of a normal calf of the same age.

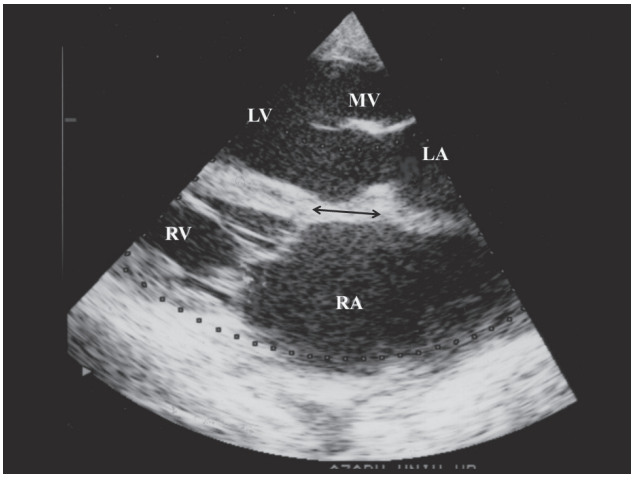

Figure 4. Ultrasonographic image of the heart in the calf with cervical ectopia cordis at 5 days of age. The left side of the figure shows the cortical apex that is directed cranially. The septal leaflet of the tricuspid valve is positioned toward the cardiac apex approximately 23 mm from the insertion of the anterior leaflet of the mitral valve (arrow). RV – right ventricle, RA – right atrium, LV – left ventricle, LA – left atrium, and MV – mitral valve.

Discussion

In the present study, the entire heart was displaced into the cervical region; however, no life-threatening abnormalities were observed. Dysplasia of the tricuspid valve observed in the present

case may indicate the presence of Ebstein's anomaly, although no clear criteria have been established for such anomalies in cattle. In cases of ectopia cordis, there is frequently simultaneous occurrence of defects and serious valve disorders, resulting in a reduced life span of the affected animals (1). In this case, reverse blood flow due to dysplasia of the tricuspid valve was observed; however, the velocity of the blood flow was slow, and no concurrent cardiac abnormalities, such as myocardial hypertrophy or wall thinning, or clinical symptoms were observed. In addition, no anomalies in the left ventricular function were observed. Thus, it can be concluded that the heart exhibited normal function as the animal showed a normal shortening fraction in the internal diameter of the left ventricle.

Although the volume of circulating blood is expected to increase with the growth of the fetus, at the time of delivery, and at lactation around the parturient period (6), the increase in circulating blood did not induce any abnormalities in this cow. The cow showed long-term survival with normal cardiac function and absence of peripheral circulation abnormalities and other organ anomalies. Hence, we postulate that this cow affected by cervical ectopia cordis is likely to be capable of sustaining subsequent pregnancies. CVJ

References

1. Hiraga T, Abe M. Eight calves of cervical ectopia cordis and their sternums. Nippon Juigaku Zasshi 1986;48:1199–1206.
2. Bowen JM, Adrian RW. Ectopia cordis in cattle. J Am Vet Med Assoc 1962;141:1162–1167.
3. Windberger U, Forstenpointner G, Grabenwöger F, et al. Cardiac function, morphology and chromosomal aberrations in a calf with ectopia cordis cervicalis. Zentralbl Veterinarmed A 1992;39:759–768.
4. Hiraga T, Abe M, Iwasa K, Takehana K, Tanigaki A. Cervico-pectoral ectopia cordis in two Holstein calves. Vet Pathol 1993;30:529–534.
5. Pipers FS, Reef V, Hamlin RL, Rings DM. Echocardiography in the bovine animal. Bov Pract 1978;13:114–118.
6. Elkayan U, Gleicher N. Hemodynamics and cardiac function during normal pregnancy and the puerperium. In: Elkayan U, Gleicher N, eds. Cardiac Problems in Pregnancy: Diagnosis and Management of Maternal and Fetal Disease. 2nd ed. New York: Alan R. Liss, 1990:5–24.